

## The Hidden Toll of Traffic Jams

Scientists Increasingly Link Vehicle Exhaust With Brain-Cell Damage, Higher Rates of Autism

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Congested cities are fast becoming test tubes for scientists studying the impact of traffic fumes on the brain.

As roadways choke on traffic, researchers suspect that the tailpipe exhaust from cars and trucks—especially tiny carbon particles already implicated in heart disease, cancer and respiratory ailments—may also injure brain cells and synapses key to learning and memory.

Columbia University's Frederica Perera discusses the link between exposure to pollutants in the womb and mental impacts in children. Plus, how New York City - one of the most congested cities in the U.S. - is improving traffic flow.

New public-health studies and laboratory experiments suggest that, at every stage of life, traffic fumes exact a measurable toll on mental capacity, intelligence and emotional stability. "There are more and more scientists trying to find whether and why exposure to traffic exhaust can damage the human brain," says medical epidemiologist Jiu-Chiuan Chen at the University of Southern California who is analyzing the effects of traffic pollution on the brain health of 7,500 women in 20 states. "The human data are very new."

So far, the evidence is largely circumstantial but worrisome, researchers say. And no one is certain yet of the consequences for brain biology or behavior. "There is real cause for concern," says neurochemist Annette Kirshner at the National Institute of Environmental Health Sciences at Research Triangle Park in North Carolina. "But we ought to proceed with caution."

To be sure, cars and trucks today generate one-tenth the pollution of a vehicle in 1970. Still, more people are on the road and they are stuck in traffic more often. Drivers traveling the 10-worst U.S. traffic corridors annually spend an average of 140 hours, or about the time spent in the office in a month, idling in traffic, a new analysis reported.

No one knows whether regular commuters breathing heavy traffic fumes suffer any lasting brain effect. Researchers have only studied the potential impact based on where people live and where air-pollution levels are highest. Even if there were any chronic cognitive effect on drivers, it could easily be too small to measure reliably or might be swamped by other health factors such as stress, diet or exercise that affect the brain, experts say.

New research from Los Angeles, a city defined by the automobile, adds to a pattern of public health studies in recent months on the surprising impact of air pollution from tail pipe exhaust. Lee Hotz has details on Lunch Break.

Recent studies show that breathing street-level fumes for just 30 minutes can intensify electrical activity in brain regions responsible for behavior, personality and decision-making, changes that are suggestive of stress, scientists in the Netherlands recently discovered. Breathing normal city air with high levels of traffic exhaust for 90 days can change the way that genes turn on or off among the elderly; it can also leave a molecular mark on the genome of a newborn for life, separate research teams at Columbia University and Harvard University reported this year.

Children in areas affected by high levels of emissions, on average, scored more poorly on intelligence tests and were more prone to depression, anxiety and attention problems than children growing up in cleaner air, separate research teams in New York, Boston, Beijing, and Krakow, Poland, found. And older men and women long exposed to higher levels of traffic-related particles and ozone had memory and reasoning problems that effectively added five years to their mental age, other university researchers in Boston reported this year. The emissions may also heighten the risk of Alzheimer's disease and speed the effects of Parkinson's disease.

"The evidence is growing that air pollution can affect the brain," says medical epidemiologist Heather Volk at USC's Keck School of Medicine. "We may be starting to realize the effects are broader than we realized."

'Evidence is growing that air pollution can affect the brain,' says a scientist in L.A.

#### The Idle Class

The number of vehicles on U.S. roads jumped 20% to 250 million in the past decade.

Tuesday is the busiest morning peak period, but Friday from 4 p.m. to 6 p.m. is America's most congested hour of the week.

The amount of delay for the average commuter was 3.5 hours for 2010. For the 10 largest urban areas it was 5.2 hours, using 25 extra gallons of gasoline per commuter.

Congestion has worsened outside of 'rush-hour' periods, with midday and overnight traffic jams accounting for about 40% of total delays.

The Washington, D.C., area had the most wasted hours for commuters last year, followed by Chicago and New York.

The Los Angeles area's freeways are more congested than that of any other U.S. or European city.

Source: INRIX, Texas Transportation Institute, Hedges & Co.

Reviewing birth records, Dr. Volk and her colleagues calculated that children born to mothers living within 1,000 feet of a major road or freeway in Los Angeles, San Francisco or Sacramento were twice as likely to have autism, independent of gender, ethnicity and education level, as well as maternal age, exposure to tobacco smoke or other factors. The findings were published this year in the journal

**Environmental Health Perspectives.**

"Based on our data, it looks like air pollution might be a risk factor for autism," Dr. Volk says. Still, there are so many possible genetic and environmental influences that "it is too soon for alarm," she says.

Exhaust fumes can extend farther from roadways than once thought. Traffic fumes from some major L.A. freeways reached up to 1.5 miles downwind—10 times farther than previously believed. An unusual weather pattern caused L.A. pollution levels to reach their most intense concentrations, not during

normal rush hours, but in the hours before dawn when people are most likely to be at home, according to recent measurements by UCLA and USC researchers.

Scientists believe that simple steps to speed traffic are a factor in reducing some public-health problems. In New Jersey, premature births, a risk factor for cognitive delays, in areas around highway toll plazas dropped 10.8% after the introduction of E-ZPass, which eased traffic congestion and reduced exhaust fumes, according to reports published in scientific journals this year and in 2009. The researchers, Princeton University economist Janet Currie and her colleagues at Columbia University, analyzed health data for the decade ending 2003.

After New York traffic managers rerouted streets in Times Square recently to lessen congestion, air-pollution levels in the vicinity dropped by 63%.

Scientists are only beginning to understand the basic biology of car exhaust's toxic neural effects, especially from prenatal or lifetime exposures. "It is hard to disentangle all the things in auto exhaust and sort out the effects of traffic from all the other possibilities," says Dr. Currie, who studies the relationship between traffic and infant health.

Researchers in Los Angeles, the U.S.'s most congested city, are studying lab mice raised on air piped in from a nearby freeway. They discovered that the particles inhaled by the mice—each particle less than one-thousandth the width of a human hair—somehow affected the brain, causing inflammation and altering neurochemistry among neurons involved in learning and memory.

To study the effect of exhaust on expectant mothers, Frederica Perera at Columbia University's Center for Children's Environmental Health began in 1998 to equip hundreds of pregnant women with personal air monitors to measure the chemistry of the air they breathed. As the babies were born, Dr. Perera and colleagues discovered a distinctive biochemical mark in the DNA of about half of the infants, left by prenatal exposure to high levels of polycyclic aromatic hydrocarbons in exhaust.

By age 3, the children who bore the mark of exhaust in their genes were developing mental capacities fractionally more slowly. By age 5, their IQ scores averaged about four points lower on standard intelligence tests than those of less exposed children, the team reported in 2009. The differences, while small, were significant in terms of later educational development, the researchers said.

By age 7, the children were more likely to show symptoms of anxiety, depression and attention problems, the researchers reported this year in *Environmental Health Perspectives*.

"The mother's exposure—what she breathed into her lungs—could affect her child's later behavior," Dr. Perera says. "The placenta is not the perfect barrier we once thought."